AVR529: Migrating from ATmega165P/169P to ATmega165PA/169PA

8-bit AVR® Microcontrollers

Application Note
Preliminary

1 Introduction

In order to optimize the manufacturing process and to further reduce current consumption, an optimized version of ATmega165P/169P has been introduced.

The ATmega165PA/169PA is a functionally identical, drop-in replacement for the ATmega165P/169P. All devices are subject to the same qualification process and same set of production tests.

ATmega165P/169P and ATmega165PA/169PA have separate datasheets. This application note outlines the differences between the two devices and the datasheets. There is also a detailed change log to assist the user at the end of the ATmega165PA/169PA datasheet. Remember to always use the latest revision of the device datasheet.

Minor differences in typical characteristics are not discussed in this document as long as the low and high limits remain the same. For detailed information about the typical characteristics, see sections “Electrical Characteristics” and “Typical Characteristics” of the device datasheets.

Note: This application note serves as a guide to ease migration. For complete device details, always refer to the most recent version of the ATmega165PA/169PA datasheet.

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2 Changes in Characteristics

This section outlines major differences in characteristics that may have an effect on the application in which the device is used. For detailed information, refer to the most recent version of the device datasheets.

2.1 Current Consumption

Active and Idle mode current consumption of the device has been reduced significantly. The tables below present typical current consumption figures at room temperature. All values are taken from device datasheets, unless otherwise noted.

Table 2-1. Typical Current Consumption of Device at Room Temperature

Mode	Condition	ATmega165P	ATmega165PA	Change
Active	V_{CC}=2V, f=1 MHz	0.35 mA	0.25 mA	- 29%
	V_{CC}=3V , f=4 MHz	2.3 mA	1.45 mA	- 37%
	V_{CC}=5V , f=8 MHz	8.4 mA	4.95 mA	- 41%
Idle	V_{CC}=2V, f=1 MHz	0.1 mA	0.055 mA	- 45%
	V_{CC}=3V , f=4 MHz	0.7 mA	0.36 mA	- 49%
	V_{CC}=5V , f=8 MHz	3.0 mA	1.6 mA	- 47%

Table 2-2. Typical Current Consumption of Device at Room Temperature

Mode	Condition	ATmega169P	ATmega169PA	Change
Active	V_{CC}=2V, f=1 MHz	0.35 mA	0.25 mA	- 29%
	V_{CC}=3V , f=4 MHz	2.3 mA	1.45 mA	- 37%
	V_{CC}=5V , f=8 MHz	8.4 mA	4.95 mA	- 41%
Idle	V_{CC}=2V, f=1 MHz	0.1 mA	0.055 mA	- 45%
	V_{CC}=3V , f=4 MHz	0.7 mA	0.36 mA	- 49%
	V_{CC}=5V , f=8 MHz	3.0 mA	1.6 mA	- 47%

2.2 System and Reset Characteristics

The table below shows the changes in characteristics of the power-on reset threshold between ATmega165P/ATmega169P and ATmega165PA/ATmega169PA.

Table2-3.
Changes in characteristics of Power-On Reset Threshold

Device	Symbol	Parameter	Min.	Typ.	Max.	Units
ATmega165P/ ATmega169P	V_{POT}	POR Threshold voltage (rising)	0.7	1.0	1.4	V
		POR Threshold voltage (falling)	0.05	0.9	1.3	V
ATmega165PA/ ATmega169PA	V_{POT}	POR Threshold voltage (rising)	1.1	1.4	1.6	V
		POR Threshold voltage (falling)	0.6	1.3	1.6	V

3 Bits and Registers

Some of the register bits have been changed and some register bits have been added.

3.1 Moved Register bits

In ATmega165PA/169PA, some register bits are in different locations within a register than with ATmega165P/169P, but neither the registers nor the bits have different names, nor are any bits relocated into other registers. The register bits that have been moved are listed in Table 3-1

Name	Device	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
EIMSK	ATmega165PA	---	---	PCIE1	PCIE0	---	---	---	INT0
	ATmega169PA								
	ATmega165P	PCIE1	PCIE0	---	---	---	---	---	INT0
	ATmega169P								
EIFR	ATmega165PA	---	---	PCIF1	PCIF0	---	---	---	INTF0
	ATmega169PA								
	ATmega165P	PCIF1	PCIF0	---	---	---	---	---	INTF0
	ATmega169P								

To make code can work for both ATmega165P/169P and ATmega165PA/169PA, it is recommended to use bit mask for writing and reading these bits. Some examples are shown below.

```
#define PCIE1_bm  ((1<<7)|(1<<5))
#define PCIE0_bm  ((1<<6)|(1<<4))
#define PCIF1_bm  ((1<<7)|(1<<5))
#define PCIF0_bm  ((1<<6)|(1<<4))

EIMSK |=  PCIE0_bm;             //Set PCIE0 in EIMSK
EIMSK &= ~PCIE0_bm;             //Clear PCIE0 in EIMSK

temp  =  EIFR & PCIF1_bm;       //Read PCIF1

EIFR  =  PCIF1_bm | PCIF0_bm;   //Clear PCIF1 and PCIF0
```

3.2 New Register Bits

Table 3-2 lists registers and bits that have been added to the device as a result of functional enhancements. In ATmega165P and ATmega169P these bit were reserved.

Table3-2.

New register bits in ATmega165PA/169PA

Addr.	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x35	MCUCR	-	BODS	BODSE	-	-	-	-	-

4 Datasheet Changes

For a summary of changes, see the datasheet revision history at the end of the ATmega165PA/169PA datasheet.

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